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Field Demonstration of Lead-Based Paint Removal and Inorganic Stabilization Technologies

by

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Disclaimer

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Foreword

The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threatens human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

E. Timothy Oppelt, Director
National Risk Management Research Laboratory

Abstract

Today the most widespread source of lead exposure in the environment of U.S. children is lead-based paint that was applied to residential buildings before 1978. Exposure to lead in paint can come from the paint chips themselves, from dust caused by abrasion on friction surfaces, or from chalking of exterior paint. A study was conducted to demonstrate the effectiveness of a wet abrasive blasting technology to remove lead-based paint from exterior wood siding and brick substrates, and the effectiveness of two Best Demonstrated Available Technologies (BDAT) to stabilize the resultant blasting media (coal slag and mineral sand) paint debris to reduce the leachable lead content. The average lead loading of the paint coating on the wood and brick substrates was 6.9 and 51.9 mg/cm^2, respectively. The effectiveness of the lead-based paint removal technology was determined using an X-ray fluorescence (XRF) spectrum analyzer (L&K shell). The XRF measurements were corroborated by analysis of substrate samples using inductively-coupled plasma atomic emission spectroscopy (ICP-AES). The effectiveness of the technologies to stabilize the debris was evaluated through the Toxicity Characteristic Leaching Procedure (TCLP). Aerodynamic particle size distributions of lead particulate generated during paint removal were measured using a multi-stage personal cascade impactor. Personal and area air samples were collected to evaluate the potential of the wet abrasive blasting technology to generate exposure levels of lead above the OSHA Permissible Exposure Limit (PEL) of 50 µg/m^3, 8 hour time-weighted average.

Wet abrasive blasting effectively removed the lead-based paint coating from both the wood and brick substrates to below the U.S. Department of Housing and Urban Development Guideline (1 mg/cm^2) with minimal or no damage to the underlying substrates ($p<0.0001$). The mean area air levels of lead-containing particulate generated during paint removal were significantly below the PEL ($p<0.001$), whereas the mean personal breathing zone lead levels were approximately three times higher than the PEL. Neither of the two stabilization technologies consistently stabilized the abrasive media paint debris to achieve a leachable lead content below the RCRA regulatory threshold (< 5 mg/L).

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Contents

Contents (continued)

Figures

Tables

Tables (continued)

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